Chapter 1 Overview

Bones and Muscles

Discover how bones and muscles work together to support, protect, and move our body.

Lessons in This Chapter

1. **Lesson 1:** Bones and Muscles
2. **Lesson 2:** Structure of Bones
3. **Lesson 3:** The Complete Skeletal System of the Body
4. **Lesson 4:** Animal Bodies

Chapter Focus

- How muscles help movement
- How bones and joints work together
- The human skeletal system
- Similarities and differences in animal bodies

Main Study Topics

- muscles
- bones
- joints
- cartilage
- skeletal system
- human body movement
- animal movement
- camel adaptations

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Lesson 1: Bones and Muscles

How muscles help the body move

Quick Check

Read each statement and mark True or False.

1. Without muscles, bones cannot move. — True / False
2. Muscles can contract and relax. — True / False

1 Movement Organs

- The human body has organs that help movement, such as muscles, bones, and joints.

2 Role of Muscles in Movement

- Muscles cover most parts of the body.
- Muscles are soft and flexible, unlike bones, which are hard and strong.
- Muscles can be compared to strong elastic bands that help the body move.

3 Function of Muscles

- Muscles pull the bones connected to them.
- This helps the body move.
- Bones cannot move by themselves. They need muscles to pull and move them.

★ **Muscles are the movers of bones.**

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Lesson 1: Bones and Muscles

Contraction and relaxation of muscles

1 How Muscles Work

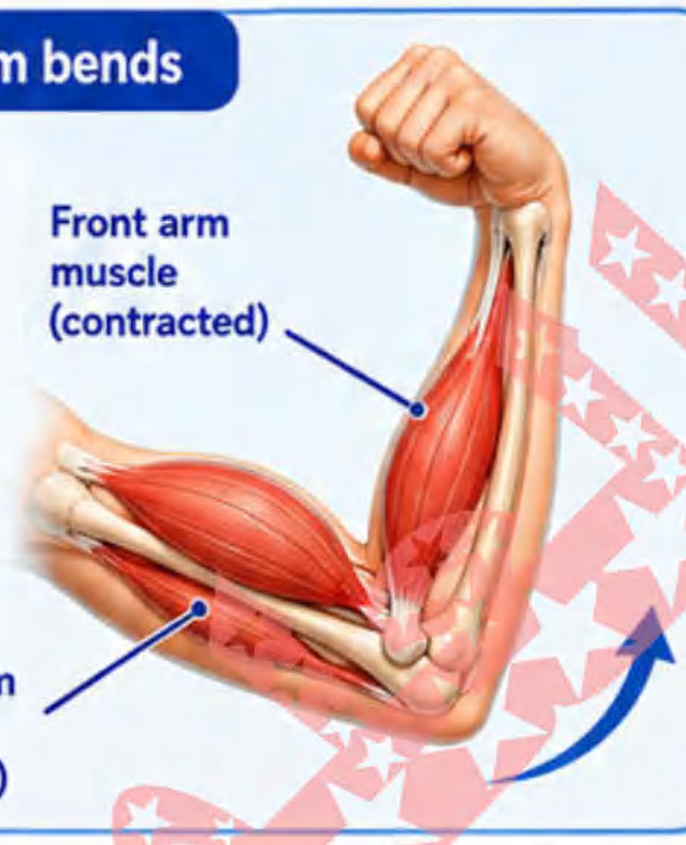
- Muscles work through contraction and relaxation.
- When a muscle **contracts**, it becomes shorter and harder and pulls the connected bones.
- When a muscle **relaxes**, it becomes longer and softer, allowing the opposite muscle to contract and return the bones to their original position.

2 Antagonistic Pairs

- Muscles usually work in antagonistic pairs.
- One muscle contracts while the opposite muscle relaxes to produce movement.

3A When the arm bends

1. The front arm muscle contracts.
2. The back arm muscle relaxes.
3. The arm bends.



3B When the arm straightens

1. The back arm muscle contracts.
2. The front arm muscle relaxes.
3. The arm returns to its original position.

4 When carrying a heavy object

- The front and back arm muscles work together to hold the arm steady.
- The arm muscles become more rigid to keep the arm in position.

5 Definitions

- **Muscles:** organs made of strong, flexible tissues. They can contract and relax.
- **Joint:** the place where bones meet and where muscles are attached.

6 Activity: Bend and straighten your arm

Steps: Bend your arm slowly toward your shoulder and touch the front and back arm muscles. Then straighten your arm slowly and touch both muscles again.

Observation: When bending the arm, the front muscle becomes shorter and harder, while the back muscle becomes stretched and relaxed. When straightening the arm, the opposite happens.

Conclusion: Muscles work in antagonistic pairs to move bones.

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Lesson 2: Structure of Bones

Bones and joints

Quick Check

Read each statement and mark Yes or No.

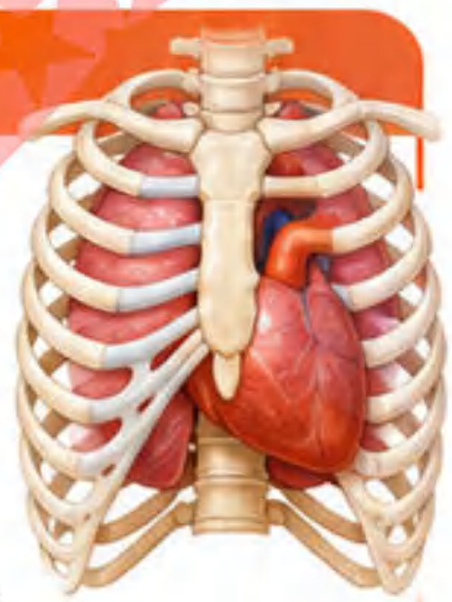
1. Bones need to be connected to each other. Yes / No
2. Friction between bones helps movement. Yes / No

1 Bones

- The human body is made of many hard, strong bones.
- Bones are not just solid parts; they are living cells that renew themselves.

2 Functions of Bones

- They help the body move, sit, and stand.
- They protect vital body organs such as the heart, lungs, and brain.
- Bones cannot move easily by themselves because they are hard and strong.
- They need joints to make movement easier.



3 Joints

- Joints are the places where two or more bones meet.

4 Functions of Joints

- They connect the ends of bones to each other.
- They help in walking, running, and bending the body.
- They allow body parts to move in an organized and easy way.

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Lesson 2: Structure of Bones

Types of joints and cartilage

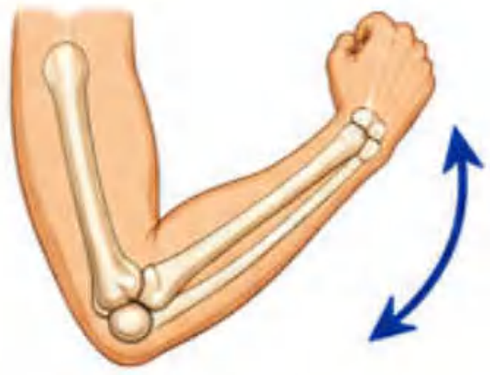
1 Types of Joints According to Movement

Limited-Movement Joints

Joints that move in one direction only.

Examples:

- Elbow joint
- Knee joint
- Ankle joint
- Finger joints



Elbow joint (bends in one direction)

Wide-Movement Joints

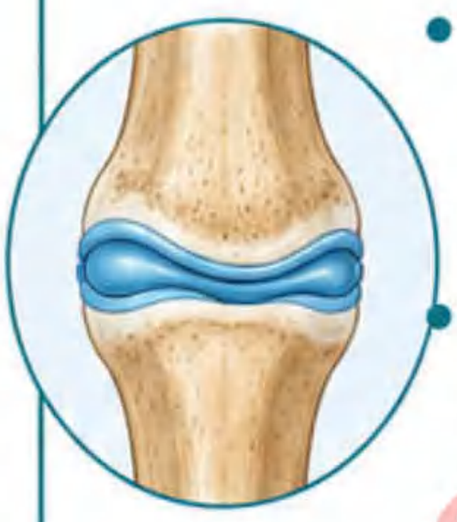
Joints that move in more than one direction. Some can rotate.

Examples:

- Shoulder joint
- Hip joint
- Wrist joint
- Neck joint

Shoulder joint (moves in many directions and rotates)

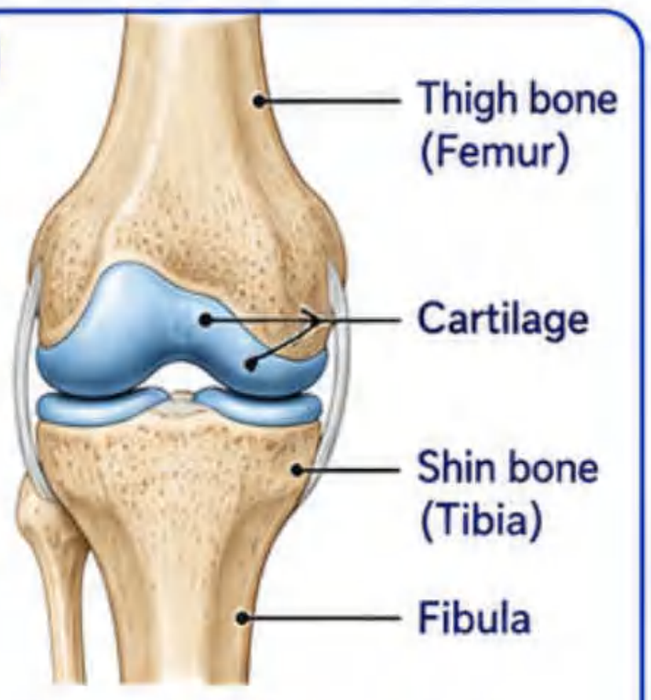
2 Why don't bones rub together inside joints?



- The ends of bones inside joints are covered with flexible materials called cartilage.
- Cartilage acts like soft cushions that absorb shocks and prevent bones from rubbing together.

3 Cartilage

- Cartilage is a soft, flexible cushion that covers the ends of bones inside joints.
- It reduces friction between bones and protects them from wear.
- It helps prevent bones from wearing away because of friction.
- It helps prevent pain during movement.



Knee joint (front view)

4 Joints in the Human Body

Upper limb joints: shoulder (wide movement), elbow (limited movement), wrist (wide movement), finger joints (limited movement).

- Each finger has three joints except the thumb, which has only two.

Lower limb joints: hip (wide movement), knee (limited movement), ankle (limited movement), toe joints (limited movement).

- Each toe has three joints except the big toe, which has only two.

Like door hinges, joints help movement.

Materials that reduce friction help parts move more smoothly.

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Lesson 3: The Complete Skeletal System of the Body

The skeleton that supports the body

Quick Check

Read each statement and mark True or False.

1. The human body is made of an unlimited number of bones. True / False

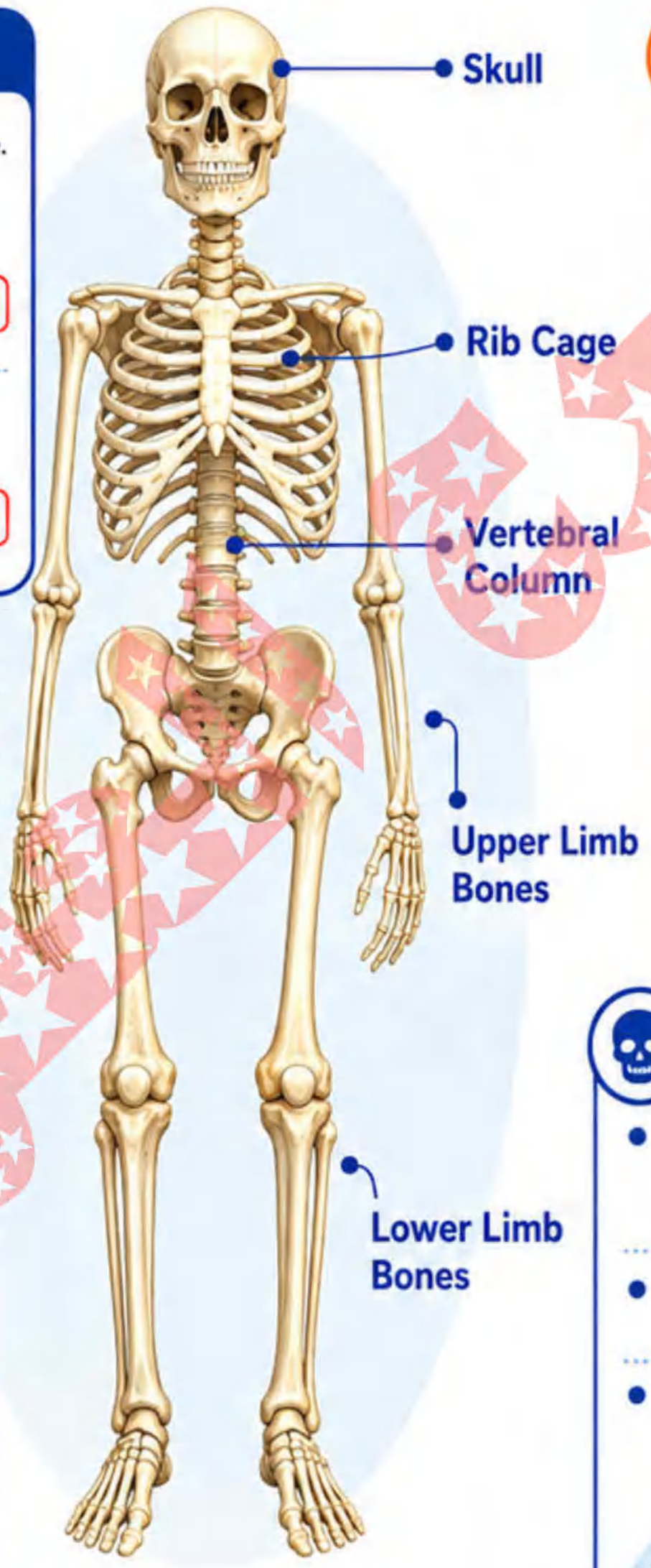
2. The rib cage is the main axis that gives the body its shape. True / False

What Is the Skeletal System?

- The adult human body is made of about **200** bones.
- Bones connect together in harmony to form the skeletal system.

Definition

- **Skeletal system:** the structure in which many bones join together to form the complete shape of the body.
- It is also a living integrated system that helps the body move.



Functions of the Skeletal System

- It gives the body its characteristic shape.
- It helps the body sit and stand.
- It protects vital internal organs such as the brain, heart, and lungs.
- It helps the body move in cooperation with muscles and joints.

Part 1: Skull Bones

- The skull is a group of hard bones connected together.
- It can be compared to a helmet.
- Its function is to surround the brain and protect it from shocks.

Bones are not all the same. They have different shapes and sizes, and each one has an important job.

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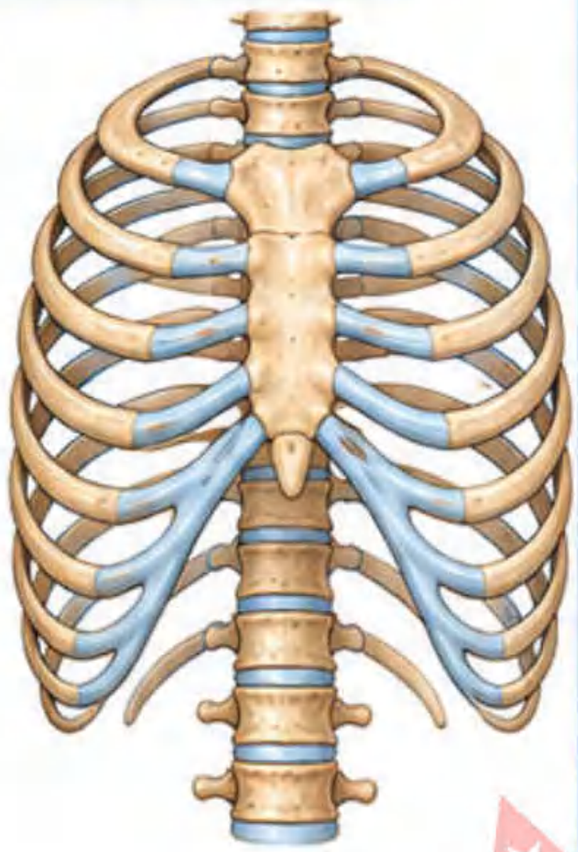
Lesson 3:
The Complete Skeletal System of the Body

Rib cage, vertebral column, and a simple activity

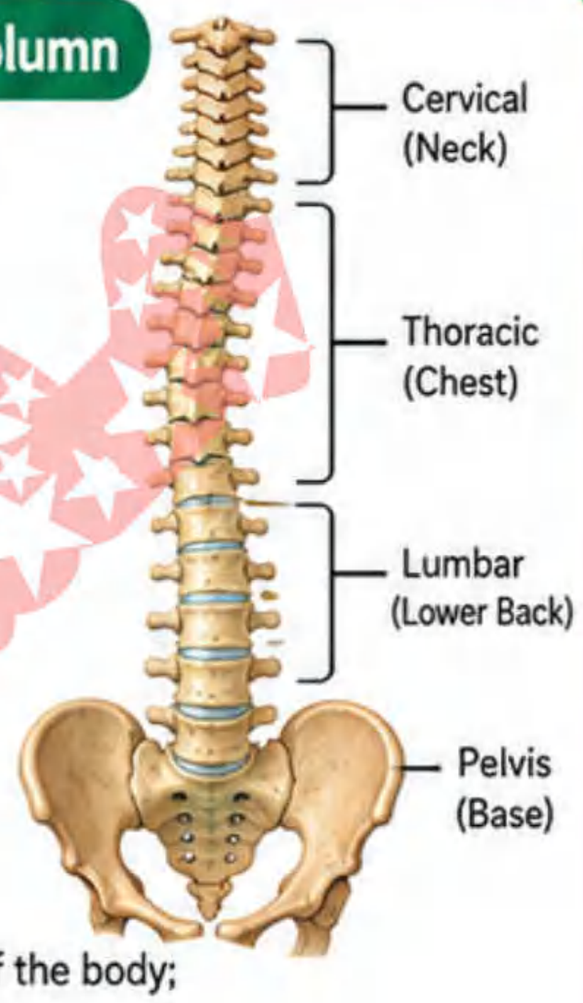
1 Part 2: Chest Bones (Rib Cage)

- The rib cage is made of thin bones arranged horizontally. These bones are called ribs.
- The ribs form a cage-like structure around the chest.
- **Function:** it protects the heart and lungs.



2 Part 3: Vertebral Column

- The vertebral column is the main column around which the body stands and many organs gather.
- All body bones are connected to it.
- It is made of small connected bones arranged vertically. These bones are called vertebrae.



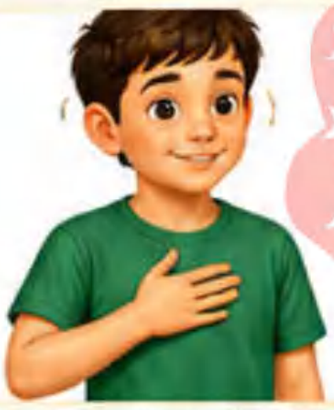
- **Functions:**
  - ✓ it acts as the main support of the body;
  - ✓ it allows the body to bend in different directions;
  - ✓ it gives the body its characteristic shape.

3 Activity: Know Your Bones

1. Touch the bones of your head.

Observation: They feel hard and solid. They are the skull bones.

Expected role: Protecting the brain.



2. Touch the bones of your chest.

Observation: You can feel thin bones under the skin. They are the ribs, and they move up and down during breathing.

Expected role: Protecting the heart and lungs.

3. Touch the bones of your back.

Observation: In the middle of the back there are small raised bones arranged vertically. They are the vertebrae.

Expected role: Helping the body bend.

Conclusion: Bones protect internal body parts and help the body bend and move in different directions.

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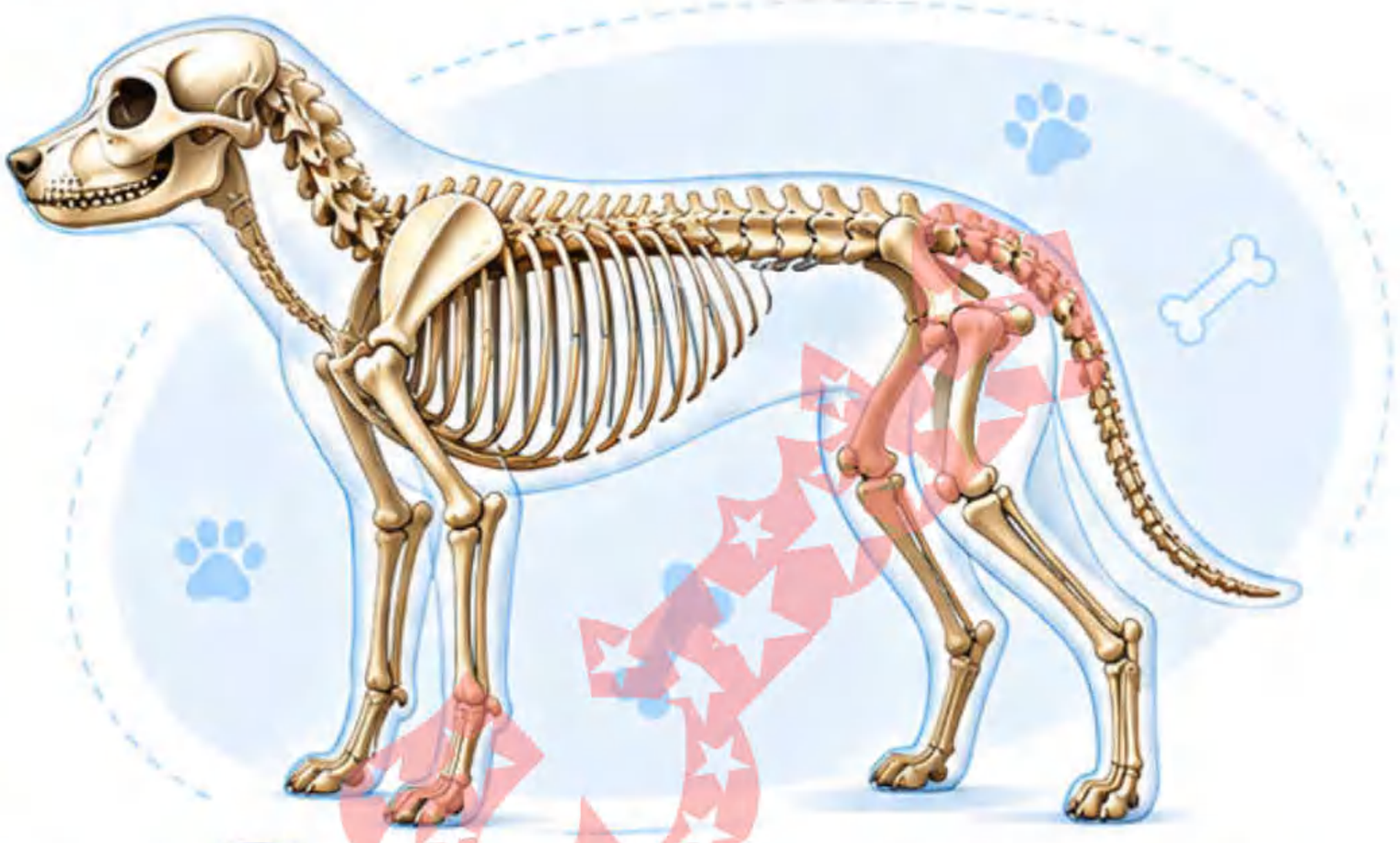
Lesson 4: Animal Bodies

Similarities and differences between humans and animals

Quick Check

Read each statement and mark True or False.

1. Animals do not have joints that connect bones together. — True / False
2. A dog's skeletal system is similar to the human skeletal system. — True / False



2 Similarity Between Human and Animal Bones and Muscles

- Many animals, such as dogs, cats, and rabbits, have bones, muscles, and joints similar to those of humans.
- Many animals move in a way similar to human movement because they have skeletal systems, muscles, and joints similar to those of humans.

3 Similarity in the Skeletal System

- **Vertebral column:** Most animals have a vertebral column in their backs similar to the human vertebral column in structure and function.
- **Bones:** Human arm bones correspond to the forelimbs of animals, and human leg bones correspond to the hind limbs of animals.
- **Joints:** The limbs of animals contain joints similar to human joints, helping movement and bending.

4 Similarity in the Movement Mechanism

- Animal bones move because muscles pull them during contraction and relaxation.
- Movement in humans and animals depends on cooperation between bones and muscles.

5 Differences in Movement

- Differences in movement are caused by differences in bone shape, bone length, the way muscles attach to bones, and muscle strength.

6 Why do bone shapes differ?

- Bone shapes differ because animals live in different environments and move in different ways.
- Some animals need to fly, such as birds.
- Some animals need to run fast, such as lions.

- ★ Animal bones and joints differ in shape, but the basic movement mechanism is similar.
- ★ The environment and the nature of each animal affect its movement and body shape.

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Lesson 4: Animal Bodies

Joints in humans and animals – and camel adaptations

A Activity: Joints in Humans and Animals

Materials: Illustrated science books and pictures of animal skeletons.

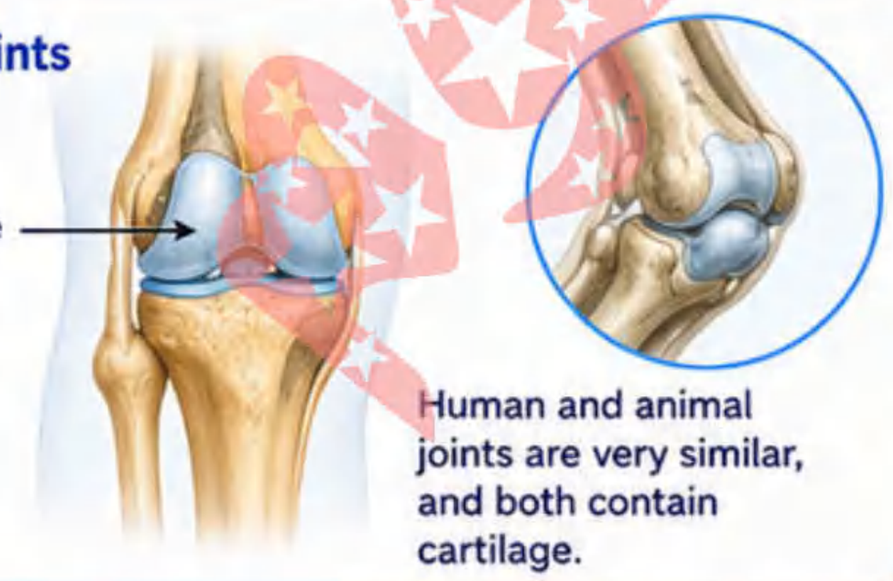
1 Dog forelimb

A dog has an elbow similar to the human elbow, but it is found near the dog's chest and is slightly higher above the ground. This helps the dog run.

2 Rabbit hind limb

A rabbit's knee is similar to the human knee, but the rabbit has very long bones in its hind legs. This helps it jump long distances and make quick successive jumps.

3 Joints



Human and animal joints are very similar, and both contain cartilage.

Conclusion

- Humans and other animals both have skeletal systems and joints that help movement.
- Bone shapes and limb lengths vary according to the environment and the needs of each animal.

B Desert Biomechanics: The Camel

- The desert has harsh living conditions, such as high temperature, lack of water because of little rain, and few plants because water is scarce.
- Animals living in the desert must adapt to these conditions.

The camel is called the ship of the desert because it can carry heavy loads and walk long distances.

Camel Adaptations

1 Shock-absorbing knee pads:

Camel joints have thick skin pads with soft tissues inside. They work like cushions that absorb shocks when the camel kneels or sits.

2 Spreading toe bones:

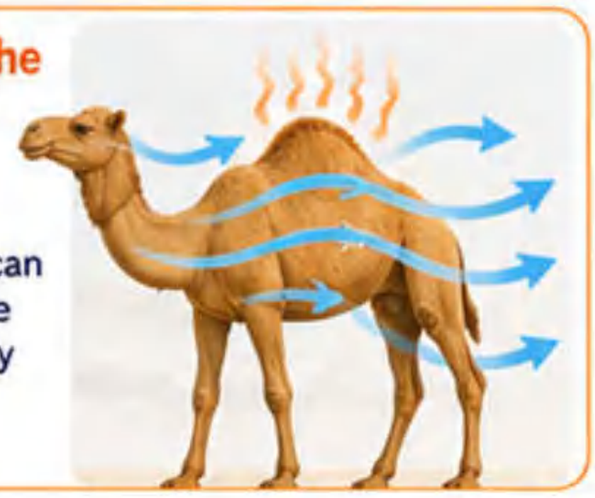
When the camel walks and its feet touch the ground, the toe bones spread so that the contact area becomes wider. This distributes body weight over a larger area, so the foot does not sink into soft sand.

3 Hump:

The camel stores extra food in the hump as fat. The camel breaks down this fat to release energy. This helps keep body temperature in very hot weather and provides energy to move the camel's muscles when food is scarce.

4 Why is the fat stored in the hump only?

Because it does not trap heat all over the body. Wind can reach the rest of the body more easily, heat can leave the body more easily, and the camel's muscles can work efficiently in intense heat.



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Chapter 1 Review

Bones and Muscles – Key ideas and quick recap

1 Muscles

- Muscles cover most parts of the body and are soft and flexible.
- They work through contraction and relaxation.
- They often work in antagonistic pairs.
- When the arm bends, the front arm muscle contracts and the back arm muscle relaxes.
- When the arm straightens, the back arm muscle contracts and the front arm muscle relaxes.
- Muscles are organs made of strong, flexible tissues.

Arm bends
Front contracts
Back relaxes

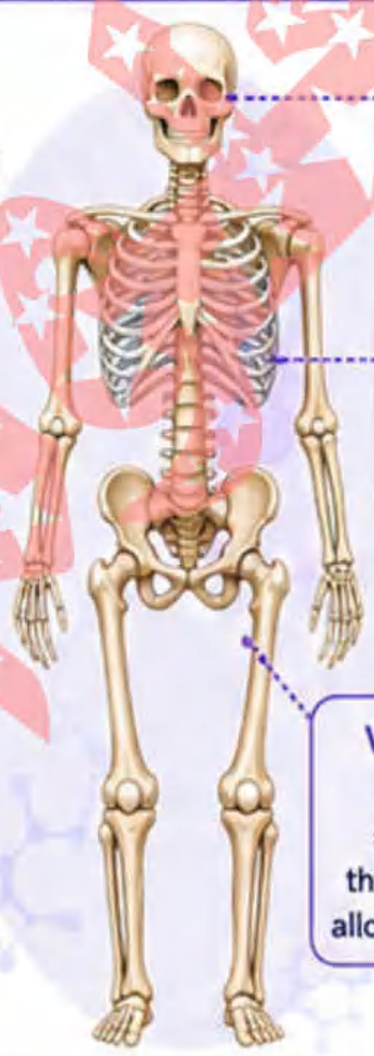
Arm straightens
Back contracts
Front relaxes

2 Bones, Joints, and Cartilage

- Bones help movement, sitting, and standing, and they protect vital organs such as the heart, lungs, and brain.
- Joints are the places where bones meet. They connect bone ends and help walking, running, and bending.
- Limited-movement joints move in one direction, such as the elbow and knee.
- Wide-movement joints move in more than one direction, such as the shoulder and hip.
- Cartilage is a soft, flexible cushion that covers the ends of bones inside joints.
- It reduces friction, prevents wear, and helps prevent pain during movement.

3 Skeletal System

- The skeletal system is the structure formed when many bones join to make the complete shape of the body.
- It gives the body its shape, helps sitting and standing, protects internal organs, and helps movement.
- The skull protects the brain.
- The rib cage protects the heart and lungs.
- The vertebral column supports the body and allows bending.



4 Humans and Animals

- Humans and many animals are similar in having a vertebral column, bones, and joints.
- The basic movement mechanism is similar because muscles pull bones and joints help movement.
- A dog has an elbow similar to the human elbow.
- A rabbit has long hind-leg bones that help it jump long distarces.
- The camel is called the ship of the desert.
- Camel adaptations include shock-absorbing knee pads, spreading toe bones, and a hump that stores fat for energy.

Remember

- ★ Movement depends on cooperation between bones, muscles, and joints.
- ★ Body structure is related to function and environment.

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